Defense Information Systems Agency
Department of Defense

Cloud Computing in a Military Context – Beyond the Hype

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Gordon Bell Quote

Every decade a new, lower priced computer class forms with new programming platform, network, and interface resulting in new usage and industry.

What is Cloud Computing?

Multiple Choice: Cloud Computing is…

a) A way to access applications hosted on the web through your web browser (Software as a Service -- SaaS)

b) A pay-as-you-go model for IT resources accessed over the Internet (Platform as a Service – PaaS)

c) Use of commodity computers, distributed throughout an internet, to perform parallel processing, distributed storage, indexing and mining of data

d) Gartner: "Cloud computing is a style of computing where massively scalable IT-related capabilities are provided 'as a service' across the Internet to multiple external customers"

e) An IT buzzword that assures potential clients that your product is on the cutting edge of technology

f) All of the above

Common Cloud Themes

- They're big – massively scalable
- Always there when you need them – on-demand, dynamic
- Only use what you need – elastic, no upfront commitments, use on short term basis
- Out there on the network somewhere – accessible via Internet, location independent
- Transparent – complexity concealed from users, virtualized, abstracted
- Service oriented – easy to use, SLAs, accessible

Simple Metaphor
Like Power Company

Better Metaphor
Cooperatively Owned Semiconductor Fab

IT Trends enabling (and driven by) Cloud Computing

- Increased Parallelism
  - ***New Moore's Law - 2X processors per chip generation***
  - ***Parallel software industries emerging to address challenges***
  - ***Redundant networks and storage increasing performance***
- Increased Virtualization
  - ***Processing, Storage, Bandwidth, Delivery***
- Commodity Components
  - ***X86 servers, consumer hard drives, ethernet***
  - ***Open Source SW – Freedom to customize and adapt***
- Increased Outsourcing of Core Elements
  - ***"By 2012, 80 percent of Fortune 1000 companies will pay for some cloud computing service, and 30 percent of them will pay for cloud computing infrastructure."*** **Gartner**

Commercial Cloud Formation

Cloud Deployment Models

Deployment Models:

- ***Internal (private) cloud.*** The cloud infrastructure is operated within the consumer's organization.
- ***Community cloud.*** The cloud infrastructure is jointly owned by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).
- ***Public cloud.*** The cloud infrastructure is owned by an organization selling cloud services to the general public or to a large industry group.
- ***Hybrid cloud*****.** The cloud infrastructure is a composition of two or more clouds (internal, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

NIST working definitions

Business Case for Cloud Computing

Automation/On-Demand = Better, Faster & Cheaper

- Moving from ‘hand crafted’ software to repeatable assembly
- Reuse of interchangeable components
- Repeatable processes with increased automation & collaboration
- Division of labor – let developers focus on new software
- Ease of use – abstract complexity out of developers’ lives
- Avoid over & under provisioning – CAPEX outlays

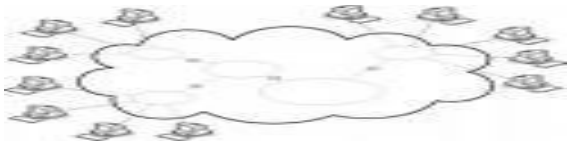
Data Intensive Computing

- Ability to index and make sense of large data sets – parallization
- Pre-format data in large repositories for low BW transmissions
- Better access to data with large multi-tenant distributed cloud databases
- Default backup and most cost effective archival of large data sets.

Accessibility = Any time, any place, any device

- Cloud serviced clients
- Leverage low cost compute cycles and assured data storage in the cloud
- Communications is pacing factor
- Challenge is to balance platform agnostic vs. end point device innovations

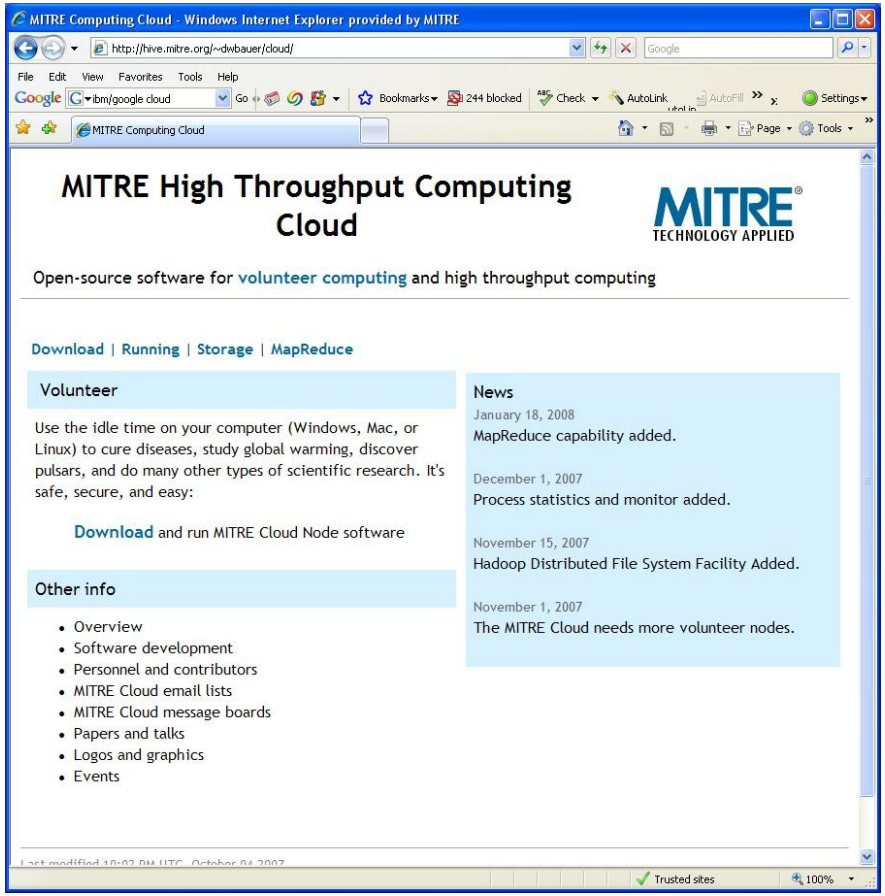
Ease of Assembly - Fabrication



Assembly Line – Muskets -> Ford **1815**	**Cloud SW Development & Deployment, Data Fusion** **2009**
Interchangeable parts, engineering tolerances	**Interchangeable abstracted resources, reuse of SW components, web service standards**
New materials handling processes	**Repeatable SW development CM processes with increased automation & collaboration**
Division of labor, specialization	**Let SW developers focus on value add new functionality, let others focus on repeatable hosting and underlying platform tasks**
Put skills in the machines, enabling use of semi-skilled rural work force	**Abstract complexity away from developers & users (virtualization, widgets, open APIs)**
Moving from hand crafted -> repeatable assembly.	

MITRE Prototype – Apr 08

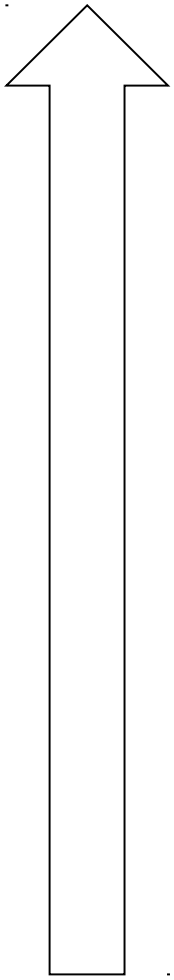
- Compute platform
  - MITRE Hive cluster
  - 32 dual-processor/dual-core nodes (AMD Opteron 2.2GHz)
  - Total online storage: 3.2TB
- Storage
  - Hadoop ver. 0.16.1
- Resource management and scheduling
  - Condor ver. 7.0
- Cloud developer user interface
  - Slax ver 6.0
- Cloud non-developer user interface
  - Adobe Flex ver 3.0
- Virtualization
  - TBD


MITRE Computing Cloud - Windows Internet Explorer provided by MITRE
http://hive.mitre.org/~dwbauer/cloud/
MITRE Computing Cloud
MITRE High Throughput Computing Cloud
MITRE
TECHNOLOGY APPLIED
Open-source software for volunteer computing and high throughput computing
Download | Running | Storage | MapReduce
Volunteer
Use the idle time on your computer (Windows, Mac, or Linux) to cure diseases, study global warming, discover pulsars, and do many other types of scientific research. It's safe, secure, and easy:
Download and run MITRE Cloud Node software
Other info
Overview
Software development
Personnel and contributors
MITRE Cloud email lists
MITRE Cloud message boards
Papers and talks
Logos and graphics
Events
News
January 18, 2008
MapReduce capability added.
December 1, 2007
Process statistics and monitor added.
November 15, 2007
Hadoop Distributed File System Facility Added.
November 1, 2007
The MITRE Cloud needs more volunteer nodes.

Cloud Related Service Offerings

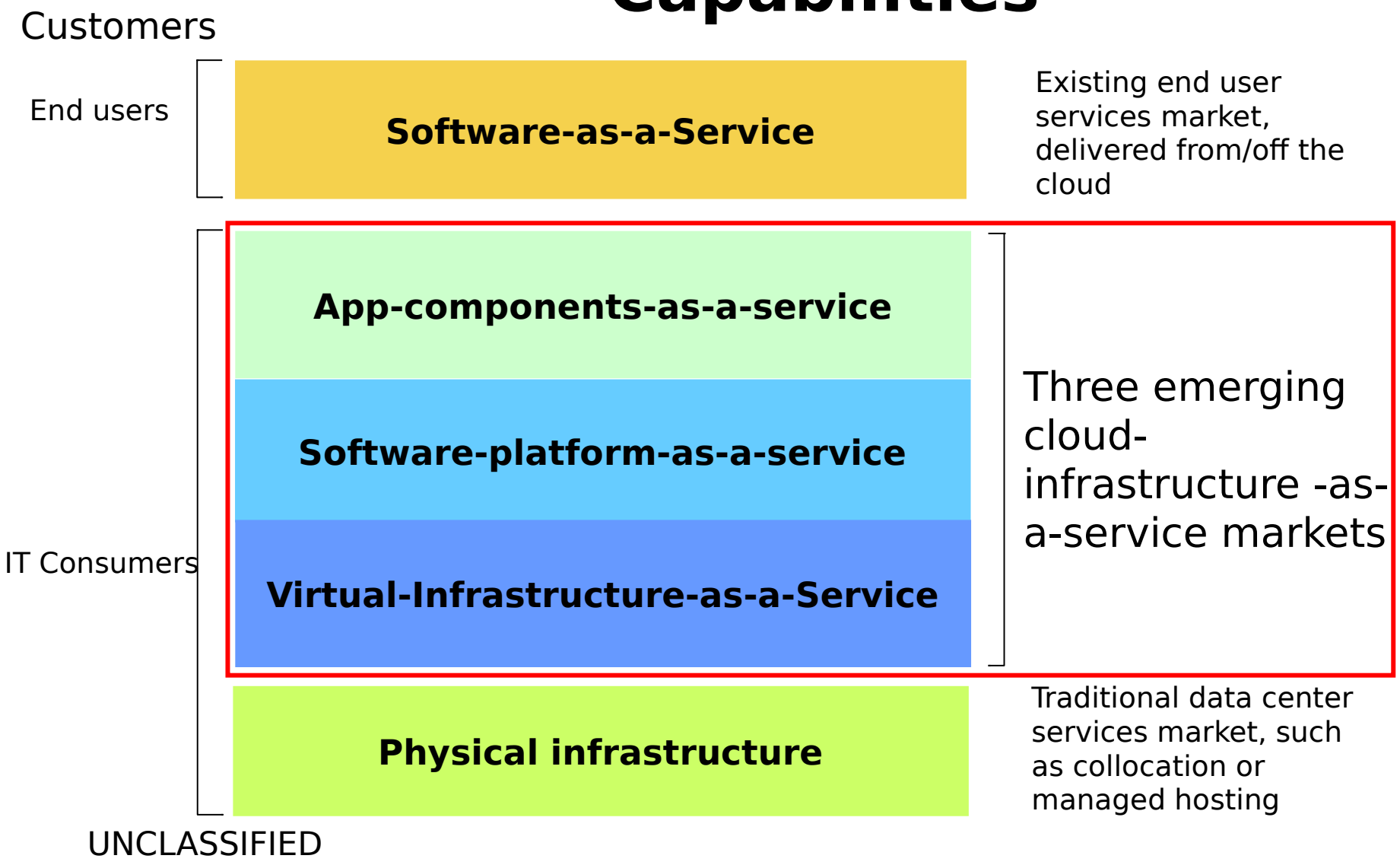
Cloud Market Types	Types of Offerings	Examples
Software-as-a-Service	• Rich Internet application web sites • Application as Web Sites • Collaboration and email • Office Productivity • Client apps that connect to services in the cloud	• Flikr • Myspace.com • Cisco WebEx office • Gmail • IBM Bluehouse
App-components -as-a-Service	• APIs for specific service access for integration • Web-based software service than can combine to create new services, as in a mashup	• Amazon Flexible Payments Service and DevPay • Salesforce.com's AppExchange • Yahoo! Maps API • Google Calendar API • zembly
Software-platform-as-a-Service	• Development-platform-as-a-service • Database • Message Queue • App Servicer • Blob or object data stores	• Google App Engine and BigTable • Microsoft SQL Server Data Services • Engine Yard • Salesforce.com's Force.com
Virtual Infrastructure-as-a-Service	• Virtual servers • Logical disks • VLAN networks • Systems Management	• Akamai • Amazon EC2 • CohesiveFT • Mosso (from Rackspace) • Joyent Accelerators • Nirvanix Storage Delivery Network
Physical Infrastructure	• Managed Hosting • Collocation • Internet Service Provider • Unmanaged hosting	• GoDaddy.com • Rackspace • Savvis

Level of Abstraction

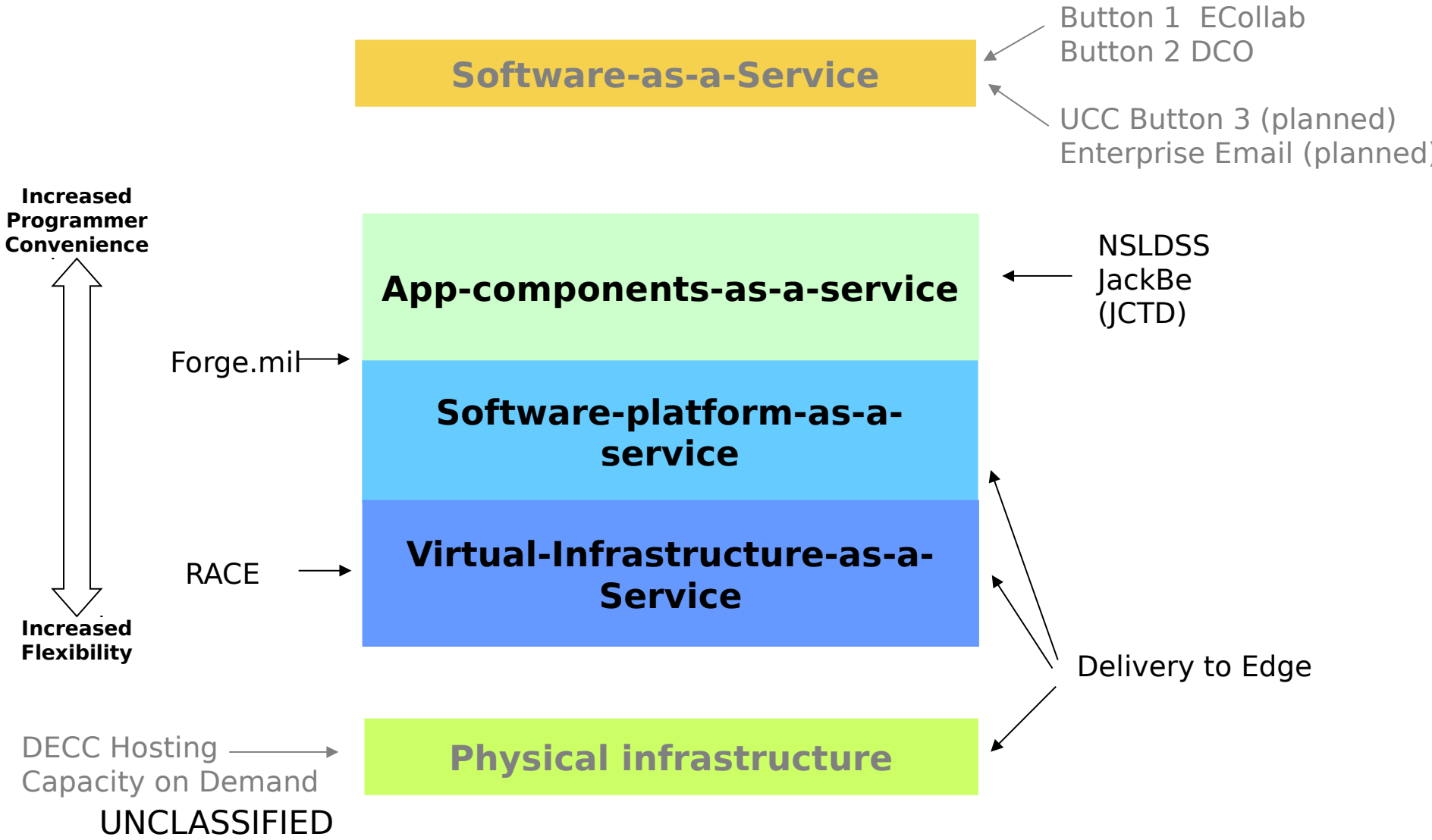


Adapted from Forrester Research Taxonomy

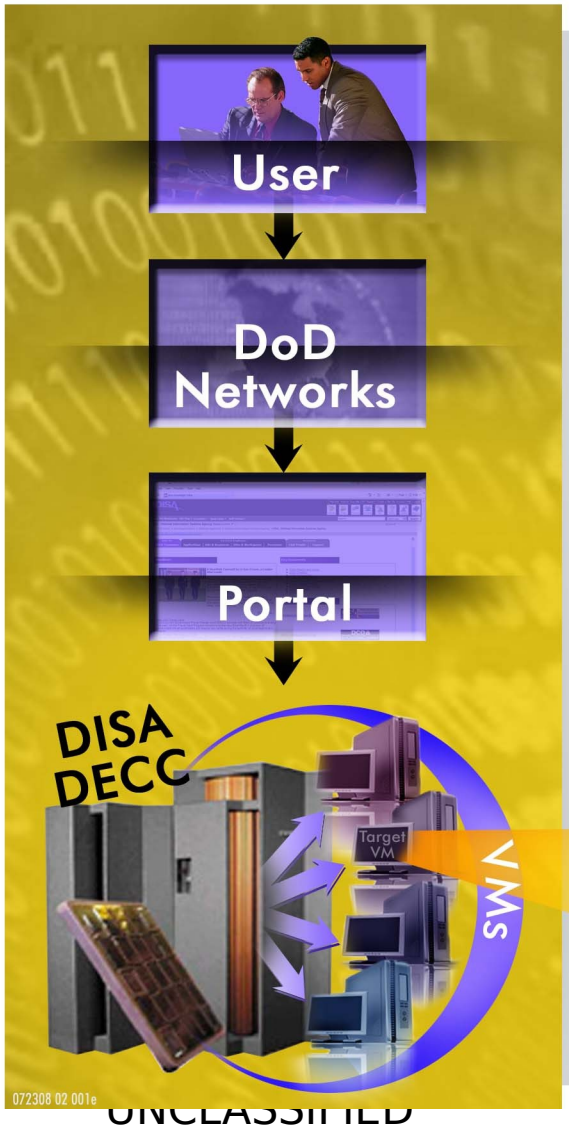
Q: Where is DISA's Cloud Focus? A: Infrastructure/Platform Capabilities



DISA Portfolio of Efforts



RACE Rapid Access Computing Environment – What is it Today?



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SERVICE OFFERING – $500/MO

- Basic Security – Developmental Testing Environment
- System admin for provisioning
- 365/24/7 Service Desk Support
- DECC Standard configuration:
  - Server Image
  - 1 CPU
  - 1 GB Memory
  - 50 GB Storage
  - OS – STIG'd or UnSTIG'd
  - LAMP stack
  - Connectivity ~ NIPR

Operating Environments

Current *Future*

Linux

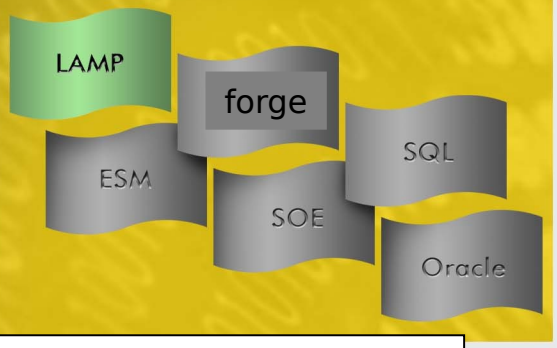
Sun HP-UX

Windows

IBM AIX

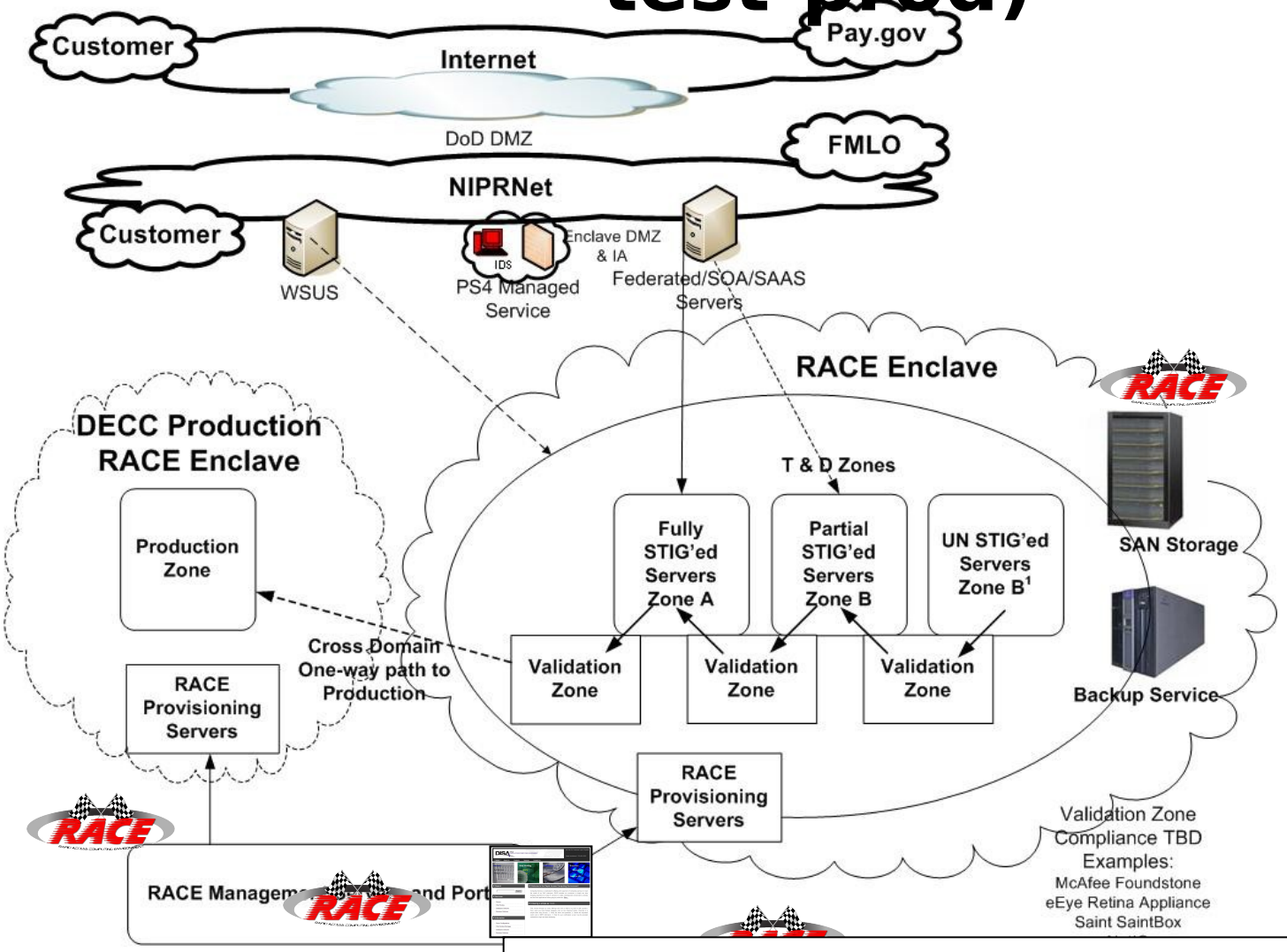
Server ready for use

Future Options



Track - Thursday, April 23 1:30-2:30 PM
CSD - Cloud Computing & Software as a Service

RACE Phase IIa Pathway to Production (dev-test-prod)



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CSD - Cloud Computing & Software as a Service

Forge.mil

- **Collaborative environment supporting the development and sharing of open source and community source software within the DoD**
- **Limited Operation Availability: January 23, 2009**
- **General Availability: March 27, 2009**

- **Common evaluation criteria and an agile certification process to accelerate the certification of reusable, net-centric solutions**
- **Limited Operational Availability: June 20, 2009**

- **On demand application development and lifecycle management tools provided buy DISA Computing Services Directorate on a fee-for-service bases for private project or program use**
- **Availability: TBD**

Track - Wednesday, April 22 1:30-5:30 PM
CTO – Introduction to Forge.mil and Panel Discussion

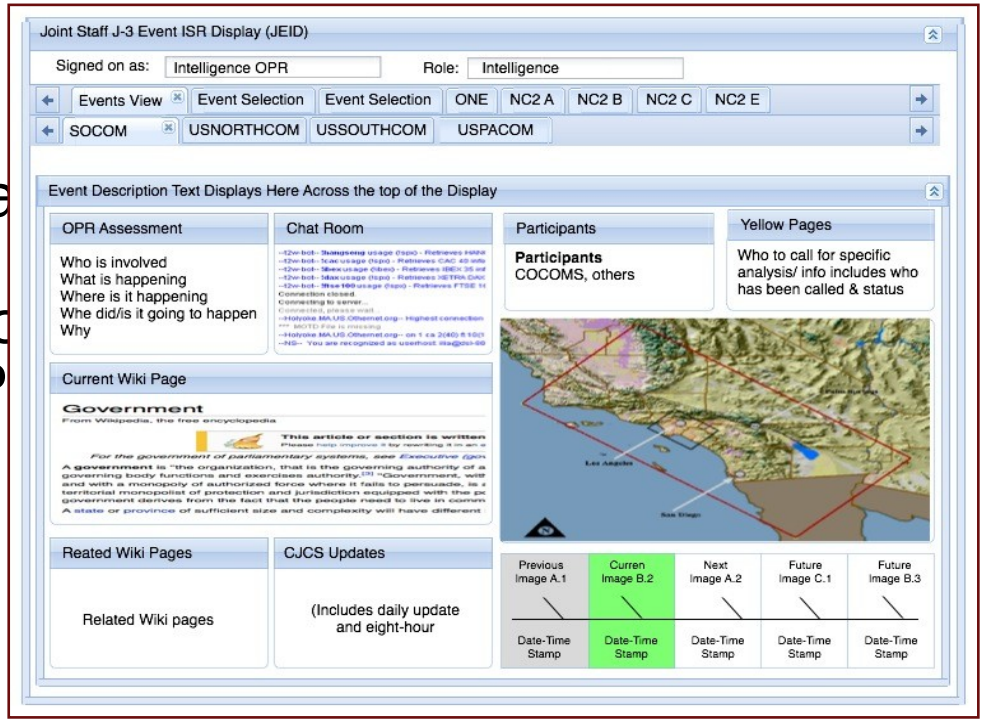
National Senior Leadership Decision Support Service (NSLDSS)

Challenge:

- Provide rapid situation awareness (SA) to support response planning and execution for Senior Leaders in Department of Defense (DoD).

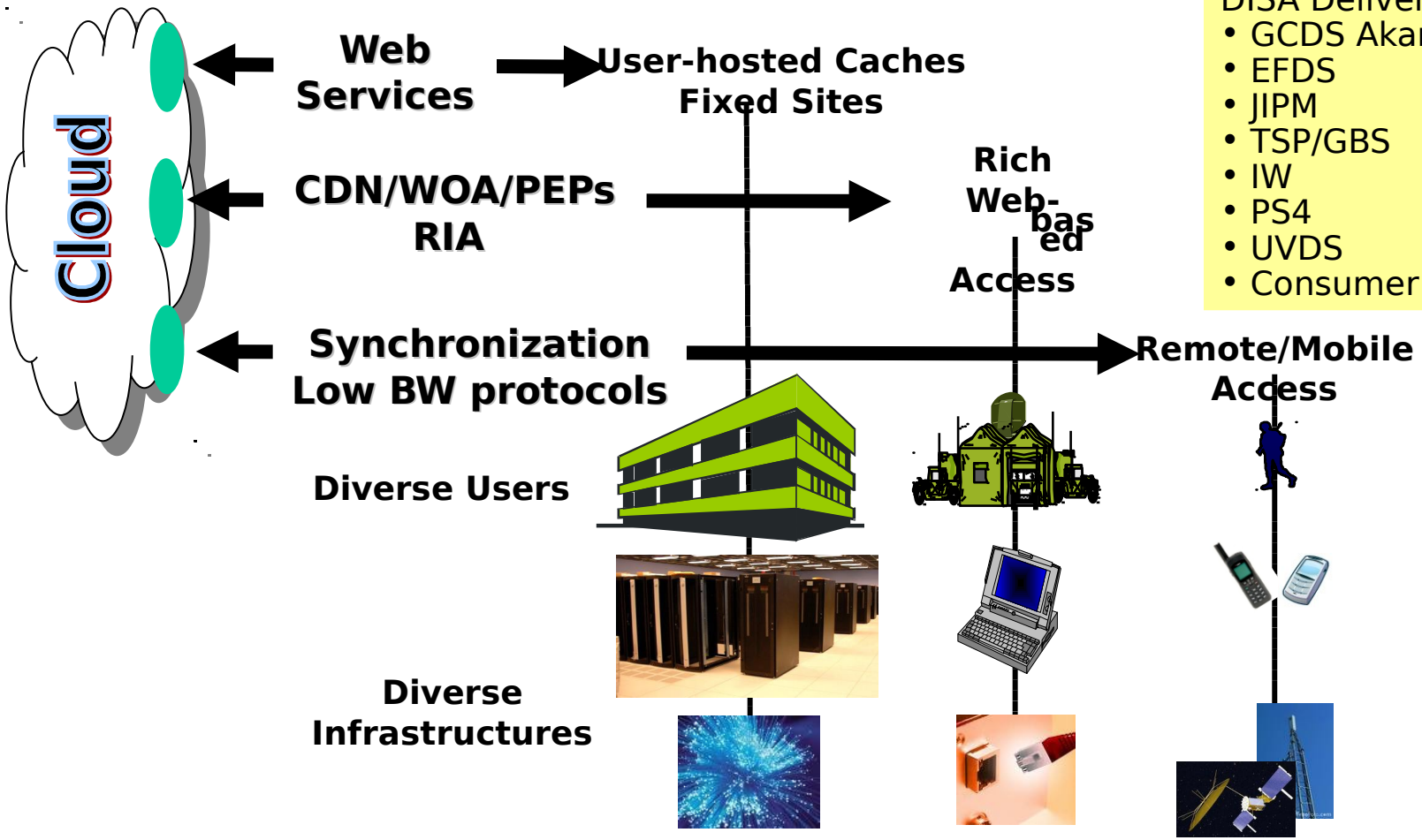
Solution:

- Implement JackBe Presto Ma
  Platform to interface with
  hundreds of disparate servic
  and data sources on the NIP
  and SIPR networks



Track - Tuesday, April 21 4:30- 5:30 PM
CTO – National Senior Leadership Decisions Support Service

Extending the Cloud to Deployed Users



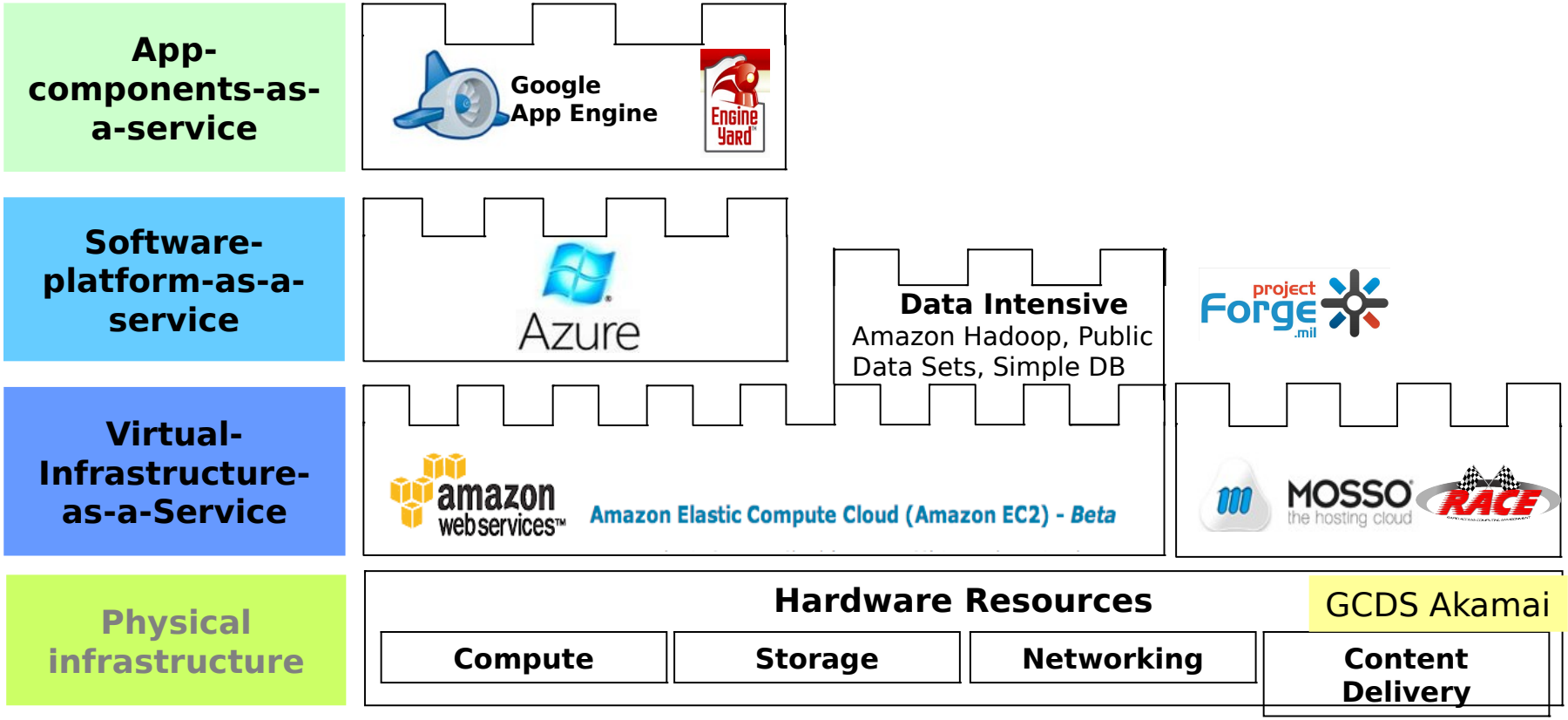
DISA Delivery Efforts
- GCDS Akamai
- EFDS
- JIPM
- TSP/GBS
- IW
- PS4
- UVDS
- Consumer RIA Clients

Track - Wednesday, April 22, 3:00-4:30 PM PEO-GES Accelerating and Optimizing the Delivery of Information
Track – Friday, April 24 8:00 – 9:00AM PEO-GES GIG Content Delivery Service and EFD Workshop
Track - Tuesday, April 21 4:30-5:30 PM PEO-STS Joint IP Modem (JIPM)

CTO Cloud Research Areas of Interest

- Automated Dev -> Test -> Production Capabilities
- Data Clouds
  - Applicability of cloud “shared nothing” databases to C2 app challenges
  - Common structured data stores handling multiple data models
- Utility Computing Programming Models for Production Environments
- Common Edge Caching & Acceleration Techniques
- Cloud serviced client platforms
  - Enterprise Mashups: Shindig/GWT, JackBe Presto
  - Geo-visualization – NASA Worldwind
  - Mediaplayers – VLC
  - Mobile computing
  - Virtual Desktop Infrastructure (VDI) soft & hard thin clients
- Common HW Infrastructure Templates & Data Center Practices

Programming Models What's the right fit for DoD?



A Vision

Plug-n-Fight

Fixed Geo-redundant Data Centers

SIPRNet

Deployable Data

Enterprise Tactical Content Delivery Network

Device RIA Clients

Do for Computing what IP did for Networks
Cloud = default background resource

CTO Cloud Research Outreach

- Partnering with other cloud researchers in DoD/IC aka Multi-Agency Cloud Computing Forum
- Working to track any emerging vendor neutral standards
- Intellipedia-U site for DISA cloud computing research
  https://www.intelink.gov/wiki/Cloud_Computing_Research_Program

Let us know about your cloud efforts
We want to partner & share!

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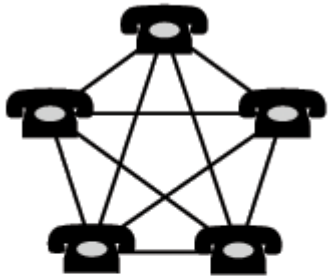
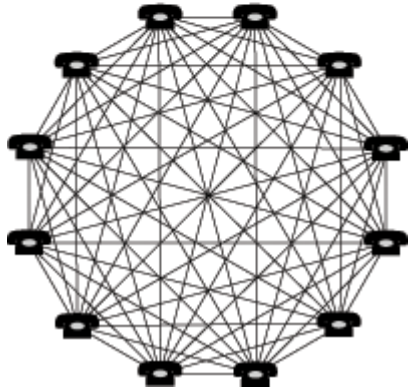
Some Suggested Readings

- "Above the Clouds: A Berkley View of Cloud Computing" 10 Feb 09 – Great overview of cloud computing < 20 pages
- Study
  - Amazon Web Services
  - Google App Engine
  - MS Azure (future)
- "Data Analysis Challenges" JASON Report, Dec 2008 – Good description of cloud applicability to DoD data analysis challenges

DEFENSE INFORMATION SYSTEMS AGENCY

Increasing the Value of "our" Cloud
Clouds Exhibit Network Effect





- **More participation increases value of the system to everyone**
- **More indexed data = greater opportunity to uncover patterns & make connections**
- **More participation in collaborative SW development = increased contributions of reusable code**
- **More design interactions = more seamless interfaces and lower friction processes**
- **More use = greater statistical multiplexing of loads = increased ability for surge computing**
- **More use = more machines = better economies of scale**

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